NPSAT1 Environmental Test

Introduction

NPSAT1 is a low-cost, technology demonstration satellite hosting a number of experiments. Commercial, off-the-shelf (COTS)-based technology will be implemented with custom designs to offer a low-cost command and data handling (C&DH) subsystem building on commercial, desktop PC architecture and standards-based specifications. In addition to an experimental C&DH subsystem, NPSAT1 will demonstrate the use of non-volatile ferroelectric RAM which is inherently radiation-tolerant and lithium-ion polymer batteries, state-of-the-art technology that will be employed offering high energy density (Watt-hr/kg) for space applications.

Experiments on-board NPSAT1 include two Naval Research Laboratory (NRL) payloads. The coherent electromagnetic radio tomography (CERTO) experiment and a Langmuir probe. The CERTO experiment is a radio beacon which, in concert with ground station receivers, is used to measure total-electron-content (TEC) in the ionosphere. The Langmuir probe will augment CERTO data by providing on-orbit measurements. The other experiments are of NPS origin. These include a novel design for a spacecraft computer board, a COTS visual imager (VISIM), and some micro-electromechanical systems (MEMS)-based rate sensors.

Description of Thesis Topic

The NPSAT1 spacecraft is configured to launch aboard the evolved expendable launch vehicle (EELV) using the EELV secondary payload adapter (ESPA). Structural integrity verification is required firstly using finite element analysis (FEA) tools and secondly through test, thereby validating the FEA results. This study would concentrate on a detailed analysis of the structure by generating a FEA model and performing various analyses to show the structure meets all launch vehicle requirements. Structural analysis would also include a fastener integrity analysis to show positive margins of safety for all load-bearing fasteners.

Proposed Outline

- NPSAT1 Introduction
- Secondary Payloads Requirements
- Overview of FEA Methods and Philosophies
- Launch Carrier Requirements
- NPSAT1 FEA Model
- Description of Analyses Performed
- Conclusions & Recommendations
- Appendix of Results

Suggested References

- General Environmental Verification Specification for STS & ELV Payloads, Subsystems, and Components, GEVS-SE, NASA/GSFC, January 1990.
- ESPA CDR Presentation and information through personal contacts